SELBY AVENUE BRIDGE
Spanning the Short Line Railways tracks at
Selby Avenue , between Hamline and Snelling Avenues
St. Paul
Ramsey County
Minnesota

HAER NO. MN-61

HAER
MINN
62-SAIPA,
34-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Rocky Mountain Regional Office
Department of the Interior
P.O. Box 25287
Denver, Colorado 80225

HAER
MINN
62-SAIPA,
34-

HISTORIC AMERICAN ENGINEERING RECORD
SELBY AVENUE BRIDGE

Location:	Selby Avenue between Hamline and Snelling Avenues St. Paul, Ramsey County, Minnesota
Quads:	St. Paul West
UTM:	Zone 15, E - 487350, N - 4976820
Construction Date:	1890
Present Owner:	City of St. Paul
Present Use:	pedestrian bridge (closed to vehicular traffic)
Significance:	The Selby Avenue Bridge is significant for its subtle delineation of an exceptional engineering solution to a difficult urban transportation design problem. Selby Avenue intersects the Short Line railroad tracks at an extreme skew. This condition necessitated other than a conventional bridge design to carry the avenue over the tracks. The bridge is also significant as the work of Andreas W. Munster, St. Paul City Bridge Engineer who went on to a prominent career with the Chicago and Great Western Railroad, and for its association with the expanding transportation systems of St. Paul during the period of the city's growth.
Historian:	Fredric L. Quivik 7301 Germantown Avenue Philadelphia, PA 19119
Date:	September 1992

SELBY AVENUE BRIDGE

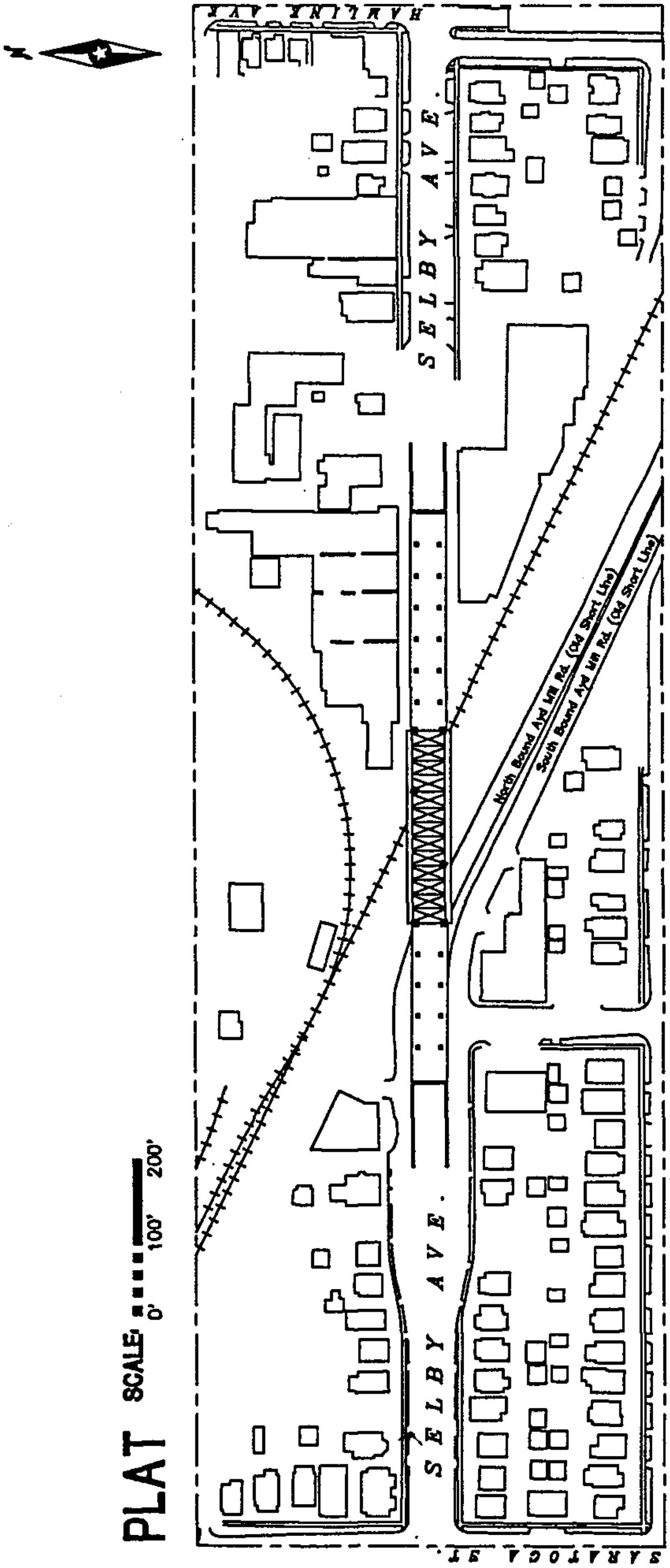
As nineteenth-century St. Paul grew, important improvements in transportation took place, both in interstate railroad service to the city and in street railway service. The first railroad, the St. Paul and Pacific, began operations in 1862 between St. Paul and St. Anthony (now part of Minneapolis), soon linked St. Paul with hinterlands to the north and west, and finally reached Breckenridge at the navigation head of the Red River in 1871. Predecessor companies to the Chicago, Milwaukee, and St. Paul Railway (hereinafter called the Milwaukee Road) began serving St. Paul from the southeast in 1867 and soon linked the city with Chicago. The Milwaukee Road also soon built a line from St. Paul west to Minneapolis by way of Fort Snelling along the Mississippi River and established feeder lines into the hinterlands of Wisconsin and Minnesota, eventually reaching as far as Fargo, North Dakota. In 1880, the Milwaukee built a more direct route, called the Short Line, between St. Paul and Minneapolis. In conjunction with other regional railroads feeding into the Twin Cities, these developments of the Milwaukee Road helped make Minneapolis and St. Paul the metropolitan center of the upper Midwest and also facilitated transportation within and between the two cities. For example, the Milwaukee inaugurated commuter service along the Short Line in the 1880s.[1]

More important improvement for intra-city passenger transport came with the advent of the street railway system in St. Paul during the 1870s. Minnesota's first horse-drawn streetcar went into service in 1872, operated by the St. Paul Street Railway Company through downtown St. Paul. Properties of this concern passed in 1877 to the St. Paul City Railway Company, which expanded the system so that by 1889 there were over 50 miles of horsecar track in the city. The year before, St. Paul witnessed the opening of the first cable-car line in Minnesota. With steep bluffs separating the downtown district from growing residential areas, St. Paul's geography encouraged a demand for the cable technology, which transmitted steam power to draw streetcars up the steep grades. Construction of the 4-1/2-mile line began in

1887 along 3rd and 4th streets from Broadway through downtown to the base of the Selby hill, up a 16% grade, and along Selby Avenue as far west as St. Albans Street. The powerhouse for the cable system was located at the corner of Selby and Dale Street, about a block east of the western terminus. After the Selby line opened, the St. Paul City Railway began construction of a second line running from downtown northeast along 7th Street to Duluth Avenue. The 7th Street line went into service in mid-1889.[2]

Between 1870 and 1890, St. Paul's population grew from about 20,000 to over 133,000. The street railway system not only moved St. Paul residents through the business districts efficiently; it served as well as an agent for expanding the residential districts to house the growing population. The original Selby Avenue cable-car line extended to the approximate western edge of settlement in St. Paul at the time. In 1890, the St. Paul City Railway extended the Selby line west to Fairview Avenue, six blocks west of Snelling. This new portion probed a rural area not yet developed with streets, lots, and urban services. As in so many other thriving late nineteenth-century American cities, the street railway system provided a mode of transportation which allowed the prospering middle class to establish bedroom communities beyond the periphery of commercial and industrial activities of the city while still working during the day in the city. Over the next three decades, lots along Selby Avenue and its neighboring streets would gradually be developed with single-family dwellings until, by World War I, the density of housing found today was achieved.[3] Such development was accompanied by increasing complexity of the urban infrastructure, and various facets of that infrastructure were incompatible with each other. For example, the intersection of the interstate railroad traffic along the Milwaukee Road's Short Line tracks and the intra-urban traffic along a thoroughfare like Selby Avenue held the potential for serious accidents. The conventional method for avoiding such danger was to physically separate the two kinds of traffic by means of a bridge.

In May 1889, the St. Paul City Council passed a resolution requesting the City Engineer to prepare and submit plans for a bridge to carry Selby Avenue over the tracks of the Short Line. A month later, City Engineer


PLAT
SCALE
0'
100'
200'
HAMLINE AVE
SELBY AVE.
SELBY AVE.
North Bound Ayd Mill Rd. (Old Short Line)
South Bound Ayd Mill Rd. (Old Short Line)
SARATOGA ST

Leonard W. Rundlett reported back to the City Council that the street on a straight alignment would cross the tracks "at a very bad angle, which largely increases the cost." Ideally, to minimize costs, a bridge should intersect the tracks or stream it crosses at a right angle. If the angle of intersection is nearly 90 degrees, the abutments and piers may often still be set normal to the alignment of the bridge, but if the angle of intersection is significantly less than 90 degrees, the substructure must be at an oblique angle to the superstructure. Bridge engineers sought to avoid such a configuration, especially in truss bridges, because it increased cost, in part because of the added difficulty of designing and constructing the portal bracing, which also had to be oblique to the trusses. Moreover, such skew bridges were considered to be "decidedly ugly."[4] Design sketches from 1889 indicate that the designer in the City Engineer's office tried at least two alternative solutions to the problem posed by the intersection of Selby Avenue and the Short Line tracks: one would have involved a single span over the tracks of 217.5 feet; the other, the one chosen, involved two spans, one of 76 feet and the other of 172 feet.[5] Analysis undoubtedly showed that the additional cost of extra piers to accommodate two shorter main spans would be less than the additional cost accrued by increasing the sizes of the members of the trusses required by the long single span. The engineers' original estimate presented to the City Council was $57,000.[6]

The same design sketches also show another set of alternatives considered by the City Engineer. The least expensive approach to bridge, bringing the roadway from grade up to the level of the trusses, would have been built of earthfill. Local property owners, however, requested that the City build trestle approaches to the bridge so there would be room for a "driveway" at grade along each side of the bridge (earthfill approaches would have been quite broad by the time they reached the deck of the main spans, some 30 feet above the level of the tracks). The design sketches do not provide cost estimates for the various alternatives, but by December 1889 the City Engineer's estimate for the alternate chosen had increased to $80,000 ($42,000 for the main spans and $38,000 for the approaches). Despite a shortage of funds in the bridge fund at the time, the City Council that month resolved to proceed with construction of the Selby Avenue Bridge, with local property owners to be assessed to pay for a portion of the cost.[7] By the time construction of the bridge was approved, one final facet of the bridge had been changed. In August 1889, nearby property owners asked the City Council to pass an ordinance extending the cable-car line west five miles along Selby Avenue past the Short Line tracks to Fairview Avenue. When passed, this ordinance created a need to design the deck of the bridge to accommodate two sets of cable and tracks.[8]

Rundlett's office took charge of the design, but Rundlett probably participated little in the effort himself, because his expertise was in water and sewer systems. Born in Brunswick, Maine in 1844, Rundlett studied engineering at Bowdoin College, graduating in 1868. He moved west to Minnesota in the early 1870s to work briefly as a teacher and then as a surveyor for the St. Paul and Pacific for three years before joining the City of St. Paul's engineering staff to participate in construction of the city's sewers. Rundlett was elected City Engineer in 1881, took charge of construction of the city's water works in 1883, and again served as City Engineer almost continuously from 1885 to 1911. He also helped to promote the broader professionalization of engineering in his city, serving as the founding president of the Engineering Society of St. Paul during the first four years of its existence (he served another term as president in 1907-08). As St. Paul's city bureaucracy evolved, Rundlett's post of City Engineer made him Commissioner of Public Works as well. Within his Public Works Department, he employed assistant engineers in charge of streets, sewers, bridges, and the like. His Bridge Engineer for the last sixteen years of the nineteenth century was Andreas Munster.[9]

Born in Bergen, Norway, in 1853, Andreas Wendelbo Munster gained a technical education at the Chalmarske Institute of Gothenborg, Sweden. After graduating in 1873, he worked as an engineer for the Norwegian Government Railroads until emigrating to the United States in 1882. His first two years were spent in Montana, first as Assistant Engineer to the Northern Pacific's Rocky Mountain Division, and then as a draftsman in Montana's Office of the

Surveyor General. In 1884, Rundlett appointed him Bridge Engineer on the St. Paul City Engineer's staff. In that capacity, Munster had charge of maintaining all of St. Paul's municipal bridges as well as designing and supervising the construction of new bridges. Finding himself at the conjunction of a major period of St. Paul's growth and the advent of the "steel age," during which industrialized steel production made a new material available for spanning broad barriers, Munster had the opportunity to design several large iron and steel bridges in St. Paul across the Mississippi River, including the 1886 Roberts Street Bridge, the 1889 Smith Avenue High Bridge, and the Wabasha Avenue Bridge, partially built in 1889 and completed in 1900. In 1900, Munster went to work for the Chicago and Great Western Railway and was appointed Chief Engineer in 1904. During a two-year term in that position, he supervised construction of railroad shops, roundhouses, and grain elevators in Iowa, Minnesota, Missouri, and Nebraska. After resigning from the railroad, Munster moved to Seattle, where he established his own consulting firm. Among his clients were the City of Seattle, the Chicago, Milwaukee, and St. Paul Railway, and the Great Northern Railway. Major commissions included bridges, docks, wharves, and freight houses.[10]

Munster's reputation was based on his large bridges and other structures. Indeed, as early 20th century engineers looked back on the history of bridge building in St. Paul, they focused their attention on the grander structures crossing the Mississippi, like the Wabasha Street Bridge and the High Bridge, as well as the outstanding open-spandrel, concrete-arch bridges for which the Twin Cities are known.[11] Nevertheless, the Selby Avenue Bridge demonstrates Munster's skill as a bridge designer, its smaller scale notwithstanding. In 1889, the City of St. Paul entered into bridge-construction contracts worth $531,445, including $285,425 for the superstructure of the High Bridge and over $156,000 for substructure and superstructure contracts for the Wabasha Street Bridge. In 1890, the year the Selby Avenue Bridge was built, the City entered into contracts worth $356,763, including $86,594 for the substructure of the Broadway Bridge and about $148,000 for the substructure and the superstructure of the Sixth Street

Bridge. Thus, the contract total of approximately $91,000 for construction of the substructure and superstructure of the Selby Avenue Bridge was by no means exorbitant in the context of St. Paul bridge-building activity of the period.[12]

Despite the Selby Avenue Bridge's small budget compared to other bridge projects, City Engineer Rundlett had this to say about it in his 1890 report:

> The most important structure completed is the Selby avenue bridge, which was designed to carry the cable line, running at a rate of twelve miles per hour, in addition to the ordinary traffic. The very bad angle at which the street crosses the railroad gives the feature of a short truss on one side being opposite the long truss on the other side of the bridge, the floor beams being at right angles to the line of the bridge. The work as constructed has proven very satisfactory, the measures taken to provide for expansion having been successful.[13]

Rundlett's description of the design challenge posed by the extreme skew demanded of the bridge suggests the significance of Munster's design solution. He was able to completely avoid both the difficult portal-bracing connections and the inherent ugliness of a skew bridge. The solution, however, necessitated some consideration for expansion not normally required of a design for a Pratt truss, which will be discussed below.

In July 1889, the St. Paul City Council instructed the City Engineer to advertise for bids to construct the substructure and the superstructure for the Selby Avenue Bridge. Twelve bridge fabricators and contractors from around the nation submitted bids (see Appendix A), reflecting the fact that Minnesota did not yet possess facilities to fabricate elements for iron and steel truss bridges.[14] The Edge Moor Bridge Works of Delaware submitted the low bid at $69,071.73 and was awarded a contract in February 1990.[15] Edge Moor sub-contracted the actual erection of the Selby Avenue Bridge superstructure to M. Riney & Co., an out-of-town contractor which established a temporary camp at the construction site.[16] Typical of bridge fabricators, the Edge Moor Bridge Works procured its structural iron and steel from a wide variety of iron and steel mills, most of which were located in Pennsylvania (see Appendix B).[17]

Newly formed in 1889, the Edge Moor Bridge Works was an outgrowth of the Edge Moor Iron Company, located on the outskirts of Wilmington. Incorporated in 1869 by the Sellers brothers, William, John, and George, the Edge Moor Iron Company manufactured boilers, fabricated structural iron, and erected bridges. Henry Morse was manager of the structural iron department, which built several significant nineteenth-century bridges and buildings. Perhaps Edge Moor's most notable project was to provide structural iron for the Brooklyn Bridge. In 1889, the Edge Moor Iron Company sold that portion of its plant used for fabricating bridges to the newly formed Edge Moor Bridge Works, of which Morse was president and William Sellers was vice president (William Sellers was president of Edge Moor Iron). The two companies shared the secretary, treasurer, and purchasing agent, indicating their closeness. In 1900, the Edge Moor Bridge Works was one of 24 bridge-fabricating and -building companies absorbed by the giant American Bridge Company.[18]

The City Council awarded a contract for $21,575 to St. Paul contractor Charles Stone to construct the substructure and grade the approaches of the Selby Avenue Bridge.[19] During the turn-of-the-century period, he operated a quarry on the south side of the Mississippi River opposite the western portion of St. Paul. As a contractor, he performed grading, excavating, and stone-masonry services for sewers, building foundations, and bridge substructures from the 1880s to the early 20th century.[20] By the end of October, the contractors had submitted their final bills for construction of the Selby Avenue Bridge.[21]

The Selby Avenue Bridge over Ayd Mill Road (formerly Short Line Road) and the Soo Line Railroad (formerly the Milwaukee Road tracks) consists of two steel pin-connected Pratt through truss main spans, twelve steel-girder deck approach spans (five at the west end and seven at the east), and sandstone abutments which also serve as approach ramps. The main spans rest on sandstone piers (the west pier has been modified to allow for a re-alignment of the Short Line Road) and the approach spans are supported by steel posts consisting of four steel Z-sections riveted with lacing bars.

The main spans of the Selby Avenue Bridge exhibit Munster's solution to the problem of the extreme skew of the street and the railroad tracks. The end piers of the main spans are perpendicular to the axis of the bridge in the conventional manner, thus allowing the portal bracing to also be normal to the trusses. The center piers, however, are significantly offset (see HAER photo No. MN-61-14). This results in an unusual configuration of the two lines of trusses relative to each other. Along the north side of the bridge, the short span (76 feet), four panels long, is at the east end and the long span (171 feet), nine panels long, is at the west end. Along the south side of the bridge, however, the short and long spans have the same respective lengths and number of panels, but the short span is at the west end and long span is at the east end (see HAER photo No. MN-61-25). This, in the words of Rundlett quoted above, "gives the feature of a short truss on one side being opposite the long truss on the other side of the bridge." As a consequence, the center pier for the north side is separated by five panels from the center pier for the south side. Furthermore, there are no inclined end posts rising from the center piers. Instead, a vertical member, consisting of two built-up steel channel sections riveted with lacing bars, rises from each middle pier and joins the intersecting diagonal members at a pin-connection in the upper chord (see HAER photo No. MN-61-28). Although there is actually a joint at this pin-connection, the upper chord looks continuous, giving the main spans the appearance of a two-span continuous truss (see HAER photo No. MN-61-1, 26).

The truss members themselves are fairly conventional for a Pratt truss. the upper chord consists of two built-up channel sections (themselves each comprised of a steel plate and two angle sections) riveted with a continuous top cover plate and with lacing bars riveted along the lower flanges. Lower chords consist of punched steel eye-bars, except for the panels on either side of the verticals rising from the middle piers. Those lower chords consist of built-up channel sections (each a plate and two angle sections) riveted with lacing bars. Vertical members also consist of two built-up channel sections riveted with lacing bars. Built-up channels for the hip verticals for the short spans consist of two steel angle sections riveted with lacing bars, and for the hip verticals for the long spans consist of two steel angle sections riveted with batten plates. For the other vertical members, built-up channel sections consist of two steel angle sections riveted with a continuous steel plate. The vertical members which rise from the middle piers can be distinguished by their greater dimension. The depth of the channel sections comprising the verticals demarking the intersection of the trusses is 18-1/2 inches, while that of the other verticals is only 14-1/2 inches (compare HAER photo No. MN-61-11, which is a larger vertical, with MN-61-12, which is not). Diagonal members for the outer panels of the long trusses (second panel from the end with inclined end post and outer two panels for the end without inclined end post) consist of four punched steel eye-bars. Other diagonal members, for both the long and the short spans, consist of two punched steel eye-bars. Counters for the middle panel of the long span are square steel rods with turnbuckles.

Although at first glance the two Pratt spans appear to be a continuous truss, the fact that they are not can be seen by the pin connections along the upper chord directly over each center pier (see HAER photo No. MN-61-11). Moreover, the locations of the offset center piers are subtly expressed to a viewer travelling along the deck by differences in the portal- and sway-bracing designs. Portal bracing consists of a deep latticed strut with steel brackets featuring ornate cut-outs in the steel plates (see HAER photo No. MN-61-31). Intermediate sway bracing consists of laced struts with ornamental brackets of a different design, simpler than that of the portal brackets (see HAER photo No. MN-61-32). Portal struts are found at four points: at the east and west portals to the through truss spans (see HAER photos No. MN-61-3, 13), where one would expect them, and at each of the verticals rising from a center pier (see HAER photos No. MN-61-8, 9, 10, 11, 12). Thus, the ornamental portal bracing serves not only to embellish an urban bridge, but as well to delineate the locations of the middle piers and the separations between the short and long trusses.

The masonry abutments and piers are of a yellowish sandstone, a characteristic building material throughout the Twin Cities, coming as it does from the nearby bluffs of the Mississippi River. All piers and abutments are of battered, ashlar construction, blocks of stone being rusticated with tooled edges. The end piers and the abutments have buttresses, atop which the ends of the approach trestles sit (see HAER photo No. MN-61-20, 22, 34, 37). Granite blocks provide the seats for the approach spans atop the buttresses and for the main spans atop the piers (see HAER photo No. MN-61-16, 17, 34, 35, 37). Conventional practice for a bridge of two main spans would place the fixed ends on the middle piers and the moveable ends on the end piers. Such conventional practice was not appropriate to the Selby Avenue Bridge because its middle piers are offset. With a short span on one side of the bridge opposite a long span on the other, the expansion of each long span in the five panels between the middle piers would be in opposite directions if the fixed ends were placed on those middle piers, placing undue stress on the floor beam connections and the bottom lateral bracing. Thus, "the measures taken to provide for expansion" to which Rundlett alluded were to place the fixed supports on the west end piers, making the ends supported on the middle piers and on the east end piers all moveable ends. This "measure" was specified in the plans (see HAER photo No. MN-61-26) and is made visible in the extant structure by the roller nests atop the middle piers (see HAER photo No. MN-61-17) and the east end piers (see HAER photo No. MN-61-16).

Originally the floor system had two pairs of tracks for cable-cars and had troughs between pairs of tracks to accommodate the cables which pulled the cars (see HAER photo No. MN-61-30). The tracks were set in a bed of concrete. The original deck consisted of 6-inch-square pine blocks resting on bridge planks along outer portions from the outer lines of tracks to the curbs and on the concrete bed between the two outer lines of tracks. The planks and the concrete bed were supported by steel I-beam secondary stringers, which in turned sat on built-up steel I-beams spanning built-up girder floor beams longitudinally. The floor beams were riveted to the vertical members below the lower chords. Cross-bracing in the floor system consisted of steel turnbuckles. Built-up cantilevered supports were also riveted to the verticals to support a plank sidewalk on each side of the bridge. While the roadway of the bridge has been altered several times, the sidewalk retains its original configuration (see HAER photo No. MN-61-15). The sidewalk also cantilevers from both sides of the approach trestles (see HAER photo No. MN-61-18) and sits atop the sandstone approach ramps of the abutments (see HAER photo No. MN-61-22). The sidewalk has original latticed guardrails along the entire length of the bridge (see HAER photo No. MN-61-23).

Currently, the deteriorated floor system consists of an asphalt wearing surface supported by short, timber, secondary stringers resting on built-up steel girder stringers which are bolted atop steel built-up girder floor beams. This is the latest in a series of modifications the floor system of the Selby Avenue Bridge has sustained. In 1902, after the St. Paul City Railway converted the Selby Avenue trolley line from cablecars to electric streetcars, it also made necessary modifications to the Selby Avenue bridge (see HAER photo No. MN-61-38). The troughs for the cables were removed. To support a concrete bed, arched steel forms were placed beneath the tracks in the central half of the bridge. The tracks were set in this bed. The two outer quarters were decked with timber bridge planks. Paving brick were then laid over both concrete and planks to provide a wearing surface. Since that time, the floor system has undergone periodic improvement, strengthening, and renewal of stringers in 1907, 1927, and 1955. When the streetcars were taken out of service, the tracks and the present paving were installed.[22]

The most substantial alteration to the Selby Avenue Bridge has been the 1960 reconstruction of one of the west main span piers to allow for the re-alignment of Ayd Mill Road. The south sandstone pier was removed to make way for the westbound lane of traffic and replaced by a steel beam which spans between a new concrete pier, built farther to the south, and a concrete buttress attached to the original north pier. A similar beam and concrete pier replaced the north steel support for the adjacent steel girder approach span. The bridge burned in October 1976, when materials being stored under the east approach caught fire. The City of St. Paul made repairs to the floor system in 1978, putting the bridge back in service.[23] The Selby Avenue Bridge was closed to all but pedestrian traffic in November 1989 because of an unsafe floor system. Many of the I-beam stringers, for example, are so corroded that daylight may be seen through what were once solid webs. The Bridge Division of the St. Paul Department of Public Works is currently designing a new structure to replace the present Selby Avenue Bridge.

The Selby Avenue Bridge was listed in the National Register of Historic Places in 1989. Because replacement of the Selby Avenue Bridge will be accomplished with federal assistance, the project must comply with section 106 of the National Historic Preservation Act of 1966 and subsequent regulations intended to protect the nation's cultural resources. This historical and photographic documentation of the Selby Avenue Bridge, sponsored by the Bridge Division of the St. Paul Department of Public Works, has been prepared as part of the mitigation of the adverse effect replacement will have on the original historic structure. Because of the replacement project, the 1890 Selby Avenue Bridge will be demolished. Historian Fredric L. Quivik took the large-format photographs, conducted the research, and wrote the narrative. He was assisted in the research by Historian Robert M. Frame, III.

ENDNOTES

1. For overviews of Minnesota's railroad history, see Theodore C. Blegen, Minnesota: A History of the State (Minneapolis: University of Minnesota Press, 1963), 295-304; and Henry A. Castle, Minnesota: Its Story and Biography, vol. 1 (Chicago: Lewis Publishing Co., 1915), 434-446. For additional overview, see Richard S. Prosser, Rails to the North Star (Minneapolis: Dillon Press, 1966), esp. chapters 3 & 4, and for detail on the development of the Short Line, pp. 28-30.

2. Prosser, Rails to the North Star, 95-96; Russell L. Olson, The Electric Railways of Minnesota (Hopkins, MN: Minnesota Transportation Museum, Inc., 1976), 34-35.

3. Stephen A. Kieffer, Transit and the Twins (Minneapolis: Twin City Rapid Transit Company, 1958), 5, 7, 15, 26; Olson, Electric Railways, 35; Sanborn Map and Publishing Co., Fire Insurance Map for St. Paul, Minnesota (1885): 1, (1888): 1, (1903): 97-101, 106, (1926): 371-373, 715-721. The role of street railways in the expansion of American urban areas has been widely documented. An excellent recent overview is Kenneth T. Jackson, Crabgrass Frontier: The Suburbanization of the United States (New York: Oxford University Press, 1985), 103-124. On the dangers of intersecting forms of traffic, see John R. Stilgoe, Metropolitan Corridor: Railroads and the American Scene (New Haven: Yale University Press, 1983), 167-188.

4. Meetings of 21 and 22 May and 18 June 1889, Proceedings of the Common Council of the City of St. Paul, Ramsey County, Minnesota, for the Year 1889 (St. Paul: Globe Job Office, D. Ramaley & Son. Printers, 1890), 182, 226. On engineers wishing to avoid skew bridges because of the difficulty of making the connections between portal bracing and the trusses, see F.C. Kunz, Design of Steel Bridges: Theory and Practice for the Use of Civil Engineers and Students (New York: McGraw-Hill Book Company, Inc., 1915), 211. The quote on the ugliness the portal bracing of skewed Pratt trusses is from Willis Whited, "Urban Bridges," Proceedings of the Engineers Society of Western Pennsylvania 22 (February 1906): 51.

5. "Proposed Bridges across C.M. and St.P.Ry at Selby Ave. for Cable Line," November 1889, drawing on file in drawer 98, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

6. Meeting of 18 June 1889, Proceedings of the Common Council of the City of St. Paul, 1889, 226.

7. Meetings of 3 and 17 December 1889, Proceedings of the Common Council of the City of St. Paul, 1889, 485-486, 495, 499, 504, 508.

8. Meetings of 20 and 26 August 1889, Proceedings of the Common Council of the City of St. Paul, 1889, 316, 334.

9. Rice & Bell's St. Paul Directory, 1869-70 (St. Paul: J.B. Bell, Publisher, and Jay Rice & Co., Publishers, 1870), listing under L.W. Rundlett; Campbell's St. Paul City Directory for 1875, 1876, 1877-78 (St. Paul: W.M. Campbell, Publisher, 1875, 1876, 1878), listings under Leonard W. Rundlett; R.L. Polk's St. Paul City Directory for 1888-89, 1890-91, 1891-92, 1895, 1898, 1900, 1902, 1915, 1917 (St. Paul: R.L. Polk & Co., 1889, 1891, etc.), listings for the offices of the City of St. Paul (near the front of the directories, prior to the alphabetical listings for individuals) and under Leonard W. Rundlett; A.R. Fenwick, ed., Sturdy Sons of Saint Paul (St. Paul: Junior Pioneer Association, 1898), 86; Illustrated St. Paul: A Souvenir of the St. Paul Dispatch (St. Paul: The Dispatch Printing Co., 1892), 120-121; "L.W. Rundlett Dies from Heart Attack; Served City Long," St. Paul Pioneer Press 14 October 1916; Fred J. Williams, "The Engineers' Society of St. Paul," Bulletin of the Minnesota Federation of Architectural and Engineering Societies 18 (October 1933): 4-6.

10. R.L. Polk's St. Paul City Directory, 1888-89, 1890-91, 1900, listings under Andrew [sic] W. Munster; "Andreas Wendelbo Munster, M. Am. Soc. C. E.," Transactions of the American Society of Civil Engineers 31 (1931): 1565-1566; Kenneth Bjork, Saga in Steel and Concrete: Norwegian Engineers in America (Northfield, MN: Norwegian-American Historical Association, 1947), 141, 144-146, 155-157.

11. Walter H. Wheeler, "Minnesota Bridge Construction," The Minnesota Techno-Log 6 (February 1926): 142-145, 160; George M. Shepard, "Twin City Bridge Construction," The Minnesota Techno-Log 7 (February 1927): 137-138, 160-162 and (March 1927): 174-175, 192-194; M.S. Grytbak, "St. Paul Bridges Fifty Years Ago," Bulletin of the Minnesota Federation of Architectural and Engineering Societies 18 (October 1933): 17-18. Although the Smith Street High Bridge, the Wabasha Bridge, and others over the Mississippi River as well as several of the major early bridges over railroad tracks are cited in these articles as significant 19th-century structures, the Selby Avenue Bridge receives no attention.

12. L.W. Rundlett, "Report of the City Engineer for the Year Ending December 31, 1889," 6-7, Table No. 4: "Bridge Contracts," 30, and A. Munster, "Report of Assistant Engineer in Charge of Bridges," 42-46, all in Annual Report of the City Engineer of the City of St. Paul, 1889 (St. Paul: Globe Job Office, D. Ramaley & Son, Printers, 1890); L.W. Rundlett, "Report of the City Engineer for the Year Ending December 31, 1889," 23-24, Table No. 4: "Bridges under Contract in 1890," 48, and A. Munster, "Report of Assistant Engineer in Charge of Bridges," 64-70, all in Annual Report of the Board of Public Works of the City of St. Paul, 1890 (St. Paul: The Pioneer Press Company, 1891).

13. L.W. Rundlett, "Report of the City Engineer for the Year Ending December 31, 1889," 23.

14. Apparently the first company in Minnesota equipped to fabricate iron and steel trusses was the Gillette-Herzog Manufacturing Company. See Fredric L. Quivik, "Montana's Minneapolis Bridge Builders, IA: The Journal of the Society for Industrial Archeology 10 (1984): 41-42.

15. Meeting of 2 July 1889, Proceedings of the Common Council of the City of St. Paul, 1889, 246; Meetings of 18 February 1890, Proceedings of the Common Council of the City of St. Paul, 1890 (St. Paul: Pioneer Press Company, 1891), 59.

16. W.T. Pierce (Edge Moor Bridge Works) to A. Munster, letter dated 13 June 1890, filed in Selby Avenue - C.M.St.P.&P.Ry Bridge File, folder no. 1, 1890-1956, Bridge Division, St. Paul Public Works Dept., City Hall Annex, St. Paul. W. Riney & Co. appeared in the 1890 Polk's St. Paul City Directory only, with facilities at the Selby Avenue Bridge construction site.

17. Inspections forms of G.W.G. Ferris & Company (Pittsburgh) dated May 1890 in Selby Avenue - C.M.St.P.& P.Ry Bridge File, folder 1, 1890-1956, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

18. I.J. Isaacs, ed., The Industrial Advance of Wilmington: A Historical, Statistical & Descriptive Review (Wilmington: The James & Webb Printing Co., 1887), 56-57; J. Thomas Scharf, History of Delaware, 1609-1888, Vol. I (Philadelphia: J. Richards & Co., 1888), 805; Delaware's Industries: An Historical & Industrial Review (Philadelphia: Keighton Printing House, 1891), 42-43; Joseph Matthew Brumbley, Sr., Where the Pigeons Slept: A History (Wilmington, DE: by author, 1990), 132-141.

19. Meeting of 4 March 1890, Proceedings of the Common Council of the City of St. Paul, 1890, 76-77.

20. R.L. Polk & Co., St. Paul City Directory, advertisements for Charles Stone, (1888-1889), 222, and (1900), 1804.

21. Charles Stone to City of St. Paul, invoice dated 1 August 1890, and Edge Moor Bridge Works to City of St. Paul, invoice dated 21 October 1890, both in Selby Avenue - C.M.St.P.& P.Ry Bridge File, folder 1, 1890-1956, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

22. Alterations to the floor system are documented in drawings dated 1907 (paid by the Twin City Rapid Transit Company), 1927, and 1955 (both paid by the Chicago, Milwaukee, St. Paul and Pacific Railroad) and stored in drawer 98, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

23. Drawings for Selby Avenue Bridge to accommodate re-alignment of Short Line Road (now Ayd Mill Road), dated November 1959, and to make repairs to floor system following fire, dated January 1978, drawings on file in drawer 98, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

Appendix A: Bidders for Erecting the Superstructure of the Selby Avenue Bridge

Bridge Contractor	Bid
Milwaukee Bridge & Iron Works	$79,876.50
George E. King	93,316.24
Detroit Bridge & Iron Company	76,190.00
Keystone Bridge Company	77,739.75
Wisconsin Bridge & Iron Works	79,834.20
Lassig Bridge & Iron Works	76,801.96
Missouri Valley Bridge & Iron Works	85,788.50
New Jersey Steel & Iron Company	74,708.00
Olaf Hoff	85,344.80
King Iron Bridge Manufacturing Company	87,141.60
Chicago Bridge & Iron Company	92,256.00
Edge Moor Bridge Works	69,071.73

Source: Bids summary sheet in Selby Avenue - C.M.St.P.& P.Ry Bridge File, folder 1, 1890-1956, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

Appendix B: Steel Manufacturers Who Supplied Edge Moor Bridge Works with Components for the Selby Avenue Bridge Superstructure

Manufacturer	Components
Columbia Iron & Steel Co. (Uniontown, PA)	I-beams
Jones & Laughlin (Pittsburgh, PA)	plate & angle sections
Catasaugna Manufacturing Co. (Catasaugna, PA)	angle sections
Kurtz & Sons (Coatesville, PA)	steel plate
Pottstown Iron Company (Pottstown, PA)	steel plate
Pottsville Iron & Steel Co. (Pottsville, PA)	plate & angle sections
Brown, Bomell & Company (Youngstown, OH)	flat & square bar
Oliver Iron & Steel Co. (Pittsburgh, PA)	plate & angle sections
Carnegie, Phipps & Company's Union Iron Mills	plate, bar, angle, channel, & zee sections
Carnegie, Phipps & Co.'s Homestead Steel Wks.	bar & rod

Source: Inspections forms of G.W.G. Ferris & Company (Pittsburgh) in Selby Avenue - C.M.St.P.& P.Ry Bridge File, folder 1, 1890-1956, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

BIBLIOGRAPHY

St. Paul City Records

Selby Avenue Bridge drawings on file in drawer 98, Bridge Division, St. Paul Public Works Department, City Hall Annex, St. Paul.

Selby Avenue - C.M.St.P.&P.Ry Bridge File, Bridge Division, St. Paul Public Works Dept., City Hall Annex, St. Paul.

Published Documents

"Andreas Wendelbo Munster, M. Am. Soc. C. E." Transactions of the American Society of Civil Engineers 31 (1931): 1565-1566.

Annual Report of the City Engineer of the City of St. Paul, 1889. St. Paul: Globe Job Office, D. Ramaley & Son, Printers, 1890.

Annual Report of the Board of Public Works of the City of St. Paul, 1890. St. Paul: The Pioneer Press Company, 1891.

Bjork, Kenneth. Saga in Steel and Concrete: Norwegian Engineers in America. Northfield, MN: Norwegian-American Historical Association, 1947.

Blegen, Theodore C. Minnesota: A History of the State. Minneapolis: University of Minnesota Press, 1963.

Brumbley, Joseph Matthew, Sr. Where the Pigeons Slept: A History. Wilmington, DE: by author, 1990.

Campbell's St. Paul City Directory for 1875, 1876, 1877-78. St. Paul: W.M. Campbell, Publisher, 1875, 1876, 1878.

Castle, Henry A. Minnesota: Its Story and Biography, vol. 1. Chicago: Lewis Publishing Co., 1915.

Delaware's Industries: An Historical & Industrial Review. Philadelphia: Keighton Printing House, 1891.

Fenwick, A.R., ed. Sturdy Sons of Saint Paul. St. Paul: Junior Pioneer Association, 1898.

Grytbak, M.S. "St. Paul Bridges Fifty Years Ago." Bulletin of the Minnesota Federation of Architectural and Engineering Societies 18 (October 1933): 17-18.

Illustrated St. Paul: A Souvenir of the St. Paul Dispatch. St. Paul: The Dispatch Printing Co., 1892.

Isaacs, I.J., ed. The Industrial Advance of Wilmington: A Historical, Statistical & Descriptive Review. Wilmington: The James & Webb Printing Co., 1887.

Jackson, Kenneth T. Crabgrass Frontier: The Suburbanization of the United States. New York: Oxford University Press, 1985.

Kieffer, Stephen A. Transit and the Twins. Minneapolis: Twin City Rapid Transit Company, 1958.

Kunz, F.C. Design of Steel Bridges: Theory and Practice for the Use of Civil Engineers and Students. New York: McGraw-Hill Book Company, Inc., 1915.

"L.W. Rundlett Dies from Heart Attack; Served City Long." St. Paul Pioneer Press 14 October 1916.

Olson, Russell L. The Electric Railways of Minnesota. Hopkins, MN: Minnesota Transportation Museum, Inc., 1976.

Polk, R.L., & Co. St. Paul City Directory for 1888-89, 1890-91, 1891-92, 1895, 1898, 1900, 1902, 1915, 1917. St. Paul: R.L. Polk & Co., 1889, 1891, etc.

Proceedings of the Common Council of the City of St. Paul, Ramsey County, Minnesota, for the Year 1889. St. Paul: Globe Job Office, D. Ramaley & Son. Printers, 1890.

Proceedings of the Common Council of the City of St. Paul, Ramsey County, Minnesota, 1890. St. Paul: Pioneer Press Company, 1891.

Prosser, Richard S. Rails to the North Star. Minneapolis: Dillon Press, 1966.

Quivik, Fredric L. "Montana's Minneapolis Bridge Builders. IA: The Journal of the Society for Industrial Archeology 10 (1984): 35-54.

Rice & Bell's St. Paul Directory, 1869-70. St. Paul: J.B. Bell, Publisher, and Jay Rice & Co., Publishers, 1870.

Sanborn Map and Publishing Co., Fire Insurance Map for St. Paul, Minnesota. New York: Sanborn Map and Publishing Co., 1885, 1888, 1903, 1926.

Scharf, J. Thomas. History of Delaware, 1609-1888, Vol. I. Philadelphia: J. Richards & Co., 1888.

Shepard, George M. "Twin City Bridge Construction." The Minnesota Techno-Log 7 (February 1927): 137-138, 160-162 and (March 1927): 174-175, 192-194.

Stilgoe, John R. Metropolitan Corridor: Railroads and the American Scene. New Haven: Yale University Press, 1983.

Wheeler, Walter H. "Minnesota Bridge Construction." The Minnesota Techno-Log 6 (February 1926): 142-145, 160.

Whited, Willis. "Urban Bridges." Proceedings of the Engineers Society of Western Pennsylvania 22 (February 1906): 45-58.

Williams, Fred J. "The Engineers' Society of St. Paul." Bulletin of the Minnesota Federation of Architectural and Engineering Societies 18 (October 1933): 4-6.